126978

XCOR Aerospace comments in reponse to FAA Notice of Proposed Rulemaking on *Licensing and Safety Requirements for Launch.*

Docket Number FAA-2000-7953 - 16

General Remarks

XCOR's Interests

In §415.1 of the proposed rule, this NPRM is explicitly limited to launch vehicles other than a reusable launch vehicle. Since XCOR's focus is on reusable launch vehicles and aircraft, our opposition to broad segments of this NPRM needs explanation. We believe this NPRM, if approved without substantial change, would adversely affect our business interests in several ways:

1) The recent regulatory past of AST, particularly the content of the final rule on RLV licensing, suggests that AST will approach RLV licensing as a modification from ELV licensing, rather than as a "clean sheet" regulatory opportunity. It is therefore in our interest to oppose any unnecessarily burdensome ELV licensing requirements lest they creep in to RLV licensing later
2) Two different customers interested in developing partially expendable, partially reusable systems have approached XCOR. These systems, designed for very low mission cost for very small payloads (less than 5% of what the FAA defines as "small"), would be economically infeasible to operate under these proposed regulations, and it is by no means clear whether ELV or RLV regulatory regimes would apply to these hybrid concepts.
3) The community of amateur and high power rocket groups represents an important training ground for future technical recruiting in the RLV industry. These regulations would effectively ban activities that are now safely practiced by amateur groups, with no justification other than the precedent set by federal range practices.
4) XCOR envisions operating our vehicles from inland private spaceports. It is our view that these regulations strongly discriminate against inland spaceports to the point that private inland spaceport development is unlikely. This runs counter to the policy interests of the United States, as expressed in 49 U.S.C. 70101(a)8, "...there is a need to develop a strong space transportation infrastructure with significant private sector involvement". In our view, the primary attraction of doing business at a private spaceport is to escape from the suffocating regulatory burden of the federal launch ranges. As this NPRM requires practices substantially similar to EWR 127-1 even for private ranges, the competitive advantage of private spaceports will be greatly diminished.

Summary of XCOR's Position on this NPRM

XCOR does not believe our concerns can be addressed by minor editing of this NPRM before making it a final rule. Instead, **the proposed rulemaking should be**

withdrawn and a new regulatory process, based on different premises, begun. The clear premise of the current NPRM, permeating every paragraph, is the assumption that the practices of the current federal launch ranges are the gold standard against which changes should be measured. As an example, *FR* p. 63924 (throughout this document, *FR* without additional citation refers to *Federal Register*, Vol. 65, No. 207) "Wherever appropriate to public safety, federal launch range practices were used as the basis for the development of the FAA's regulatory regime."

As long as this philosophy drives the regulatory process, no meaningful improvement over the status quo is possible, and the U.S. will continue to lose market share in the worldwide launch market. In fact, if the goal of AST is merely to codify current practice, then this NPRM is unnecessary – private launch licenses have been and are being issued today, from federal and non-federal ranges, without this NPRM in place.

The development of the first new rules for U.S. launch operations is a historic, once in a generation opportunity to take U.S. launch practices forward to a commercially viable regime. The strictures of the rulemaking process prohibit the vigorous dialogue needed to develop such a rule once the NPRM is released. That is why XCOR recommends the FAA withdraw the rule and begin afresh.

The FAA carries the twin missions of protecting the safety of the public and fostering the growth of the commercial launch industry. For example, the enabling legislation for this NPRM, 49 U.S.C. 70101(a)7, states "the United States should encourage private sector launches, reentries, and associated services and, ***only to the extent necessary***, regulate those launches, reentries, and services ..." and 49 U.S.C. 70101(a)6 states "providing launch services and reentry services by the private sector is consistent with the national security and foreign policy interests of the United States and ***would be facilitated by stable, minimal, and appropriate*** regulatory guidelines that are fairly and ***expeditiously*** applied". (emphasis added). 49 U.S.C. 70101(b) states, in part, that the reason for establishing space launch licensing under DOT is "(1) to ***promote*** economic ***growth and entrepreneurial activity*** through use of the space environment for peaceful purposes; (2) to encourage the United States private sector to provide launch vehicles, reentry vehicles, and associated services by – (A) ***simplifying and expediting*** the issuance and transfer of commercial licenses..."

Current practice, in the absence of this NPRM (as stated several times in this NPRM, as on *FR* p. 43924, c. 2) already protects public safety. It is our belief that this NPRM does nothing to promote the growth of the commercial launch industry – indeed, by codifying current practices of the federal ranges and requiring private launch sites to conform, it removes one of the few incentives for badly needed private investment in launch infrastructure.

As an example of a contrasting paradigm, consider the licensing regime covering experimental aircraft today and the emerging regulatory regime for unmanned aerial vehicles (UAVs). Another alternative paradigm is the field of high power rocketry, with launches outside the "amateur" exemption and an excellent safety record, with almost no paperwork (small USLVs). Today, in any given year, far more flights of these kinds of vehicles take place than licensed commercial launches. In this different environment, public safety is being maintained, and yet operational practices have developed which permit overland flight from inland operating locations, and the most burdensome aspects of the NPRM are not applied. XCOR believes a "clean sheet" regulatory approach is required, in which **each and every regulatory requirement must be justified by showing that it is required for public safety, with far more justification than pointing to the precedent of federal launch ranges**. In the succeeding sections, we will take these issues point by point and question the requirements for them, in part by comparing them to other vehicle operation regimes. In each case, we will recommend an alternative derived from other regulatory regimes – in many cases, we will recommend deleting the requirement where other regulatory approaches have found it unnecessary.

§415, Section by Section Comments

§415.105(b)

Congress, by statute, in 49 U.S.C. 70101, makes clear that licenses should be issued "expeditiously". Up to this date, the timeline for license approval has been 180 days. While XCOR supports the value of pre-application consultation in complex licensing situations, the requirement to begin this consultation up to 24 months in advance of flight makes a mockery of the legislative intent of Congress. In particular, while six months in advance of flight, a description of the vehicle will be available, relatively simple vehicles (including unguided suborbital launch vehicles), can complete the entire project, from the decision to initiate the project through flight in not much more than six months. In such a case, requiring a pre-application consultation more than six months in advance of flight is a de-facto stretch-out of the license approval process.

Prior to this NPRM, the FAA has encouraged pre-application consultation as likely to simplify the licensing process and reduce the likelihood of an application being rejected for missing or incomplete information. XCOR believes that approach is more constructive than a deadline that may substantially pre-date the beginning of a vehicle project and should remain the future practice.

In the explanatory remarks, for example at FR p. 63946, c. 1, the FAA justifies one of the many early deadlines in the NPRM thusly: "Significant FAA resources will be required to review the analysis data … Similar coordination between a launch operator and the range safety organization for launch from a federal range typically begins two or more years before launch". This is a legitimate concern that must be addressed – XCOR believes very strongly that the 180 day horizon for license application is the greatest delay compatible with the requirements of commercial enterprises for small, suborbital vehicles. **If the FAA requires more than 180 days to review the material, this is a signal that the FAA is requiring excessive material**, not that the deadlines should be moved earlier in time. Recall that the whole point of enabling launch from non-federal ranges is to enhance the competitiveness of the U.S. launch industry – not to ensure that non-federal ranges are compelled to move as slowly and expensively as federal ranges. The body of the remarks points out many elements of the analysis that XCOR believes to be inappropriate or unnecessary for many types of vehicle.

§415.109(c)

Current practice in ELV launch is to have "launch windows", periods of time during which the launch may take place, and alternatives. The proposed rule fails to make clear that the "launch time" is not a point, but is a range of possible times during which launch may take place. In the case of suborbital vehicles without the constraints of precise orbit insertion, these launch windows could be quite wide (several days long). The rules should make clear that this is permissible.

§415.109(g)

The majority of the comments made in the February 2000 online forum on AST licensing for "small rockets" made clear that three sigma trajectory dispersion was an impractical requirement for the majority of unguided suborbital launch vehicle (USLV) operators, most of whom are not-for-profit groups with very small budgets. See the archive of that online forum for a more detailed discussion.

USLV launches every year within the scope of these rules number in (at least) the hundreds, have a demonstrated excellent safety record, and have traditionally never conducted three sigma trajectory analyses. XCOR believes that in the absence of clear and convincing evidence that this kind of analysis is required to protect the public on ALL launches covered by the NPRM, the requirement is inappropriate. Indeed USLVs have flown for generations with nothing more than an airspace waiver process, calling into serious question the assertion in the FAA "Comparison to current practice" document that these are current practice. Current practice for a Titan IV and for a Tripoli high power rocket launch going to 40,000 feet are not the same.

§415.115(a)

XCOR will discuss the inappropriate criteria for flight safety analysis suggested by the NPRM in our discussion of §417. However, we once again voice our vehement opposition to any deadlines for application material that predate the 180-day license submission. Is the FAA seriously proposing that every one of the thousands of members in various high power rocketry associations, who routinely take projects from concept through launch in less than 180 days, must nevertheless submit their flight safety analysis **18 months** before launch once their powered flight duration exceeds 15 seconds? We do not believe that constitutes "simplifying and expediting" the issuing of a license compared to generations of successful USLV practice (some high power rocketry groups have been active since before the establishment of NASA)

§415.115(b)

COLA (Conjunction On Launch Assessment, a.k.a. COLlision Avoidance) is not part of the prior practice for USLV, nor is it part of the prior practice for experimental aircraft flight. In both cases, procedures are in place to serve a similar function, with much less administrative overhead – namely, to be where the traffic is not, rather than to check on a flight by flight basis for conjunctions with other traffic. Again, current practice for a Titan IV launch and current practice for an amateur rocket are different. Both have a successful operational history. We vigorously oppose treating a rocket-powered aircraft or a USLV using the principles and practices derived from the national launch ranges.

The alternative, derived from USLV and experimental aircraft practice, is to not require a COLA if operating in airspace or orbital space devoid of traffic. Very few satellites are on orbit below, for example, 60km altitude, and many areas in the U.S. have very low air traffic density and are suitable for rocket flight using established processes for air traffic control coordination.

§415.117

XCOR will discuss the inappropriate criteria for ground safety analysis suggested by the NPRM in our discussion of §417.

§415.117(b)

XCOR is strongly opposed to any deadlines for application material that predate the 180 day license submission. Once again, consider the case of a small USLV rather than a large traditional ELV – a USLV which likely contains absolutely no ground hazards which are not already well regulated through organizations such as the BATF and local fire authorities through codes such as NFPA 1127. What possible public safety justification is there for requiring these projects to file paperwork 12 months before launch?

§415.119

XCOR will discuss the inappropriate criteria for launch plans suggested by the NPRM in our discussion of §417. Planning is good, but XCOR differs with the NPRM on what the requirements for that plan should be.

§415.119(l)

XCOR observes that most USLVs and most experimental aircraft do not employ a countdown at all – they use a checklist. A checklist may suggest a timeline for events, but most fundamentally it is an ordered list of events or actions which must take place to prepare for flight. When the Lunar Module took off from the Moon, it followed a checklist, rather than a countdown. Our own operational experience with rocket propulsion tests has shown that checklists are sometimes more appropriate than countdowns.

Since we oppose the requirement for a countdown, we oppose all of those subparts which refer to items unique to a countdown and not present in a checklist, including, but not limited to, portions of subsections 3 and 5.

§415.119(o)

XCOR's objections to the proposed regulations covering the flight termination system encompass the entire FTS approach right down to the requirement to have one. One small consequence is our opposition to this section. Whereas most sections of §415 require plans and procedures to be in place and §417 delineates them in detail, §415.119(o) jumps to requiring plans for piece part qualification of a subsystem we disagree on the most fundamental need for. For each and every subsection of this section, where are the FAA's data to support the assertion that this enhances public safety? Where is the cost/benefit analysis which suggests that the improvement (if any) in public safety justifies the clear conflict with the FAA's mission to simplify the issuance of commercial licenses?

§415.121(a)

As mentioned above, XCOR proposes that checklists, rather than countdowns, are an acceptable and potentially superior control mechanism. Hence, we object to requiring a launch schedule, referenced to liftoff, for the various tests, reviews, rehearsals, etc. What data suggests that committing, months in advance of launch, that a certain test will take place 15 days, 3 hours, 45 minutes, and 17 seconds in advance of liftoff contributes to any of the goals of the FAA?

§415.123

This section again illustrates the need for a "clean sheet" regulatory approach. Section (a) makes sense – requiring an applicant to describe safety critical software functions forces them to identify them and consider failure modes and effects. Section (b) continues in this vein – and then, in subsections (1) through (8), additional requirements are levied. What is the data base that shows these are required to protect public safety? What will the FAA do with this information that justifies the expense of compiling it? To select at random, what will the FAA do with "(5) Listing of operator user manuals and documentation by title and date" that enhances public safety or promotes the growth of the industry?

§415.127 & §415.129

XCOR objects to all the elements of this NPRM covering flight safety systems. (We present those objections in our discussion of §417). In this section, XCOR is strongly opposed to any deadlines for application material that predate the 180-day license submission deadline. We can see no public policy justification for requiring submission of material 12-18 months in advance of launch when small vehicles such as USLVs may take only 6 months for the entire project. Such requirements are an obstacle to the growth and health of the private launch industry.

§415.131(b)

In the free marketplace, individuals are allowed to change jobs, leave companies, etc. Therefore requiring the name of the senior flight safety official as part of the license application forces a launch operator to amend their license application for personnel changes. This should be changed to either:

1) Eliminate this requirement – the operator is already being forced to ensure that their personnel meet FAA guidelines; what further purpose is served by naming him?
2) Permit operators to name several individuals, qualified to fulfill this role, and allow any of them to fulfill the role while staying within the pre-existing launch license.

§C415

XCOR believes that for a broad class of launch vehicles (employing liquid or hybrid propulsion and non-toxic propellants) most of the proposed elements of ground safety analysis are unnecessary and duplicate regulation already in place through federal, state, and local regulatory authorities. We will discuss this in greater depth in our analysis of §417. By reference, we believe that in these cases the majority of the requirements in §C415 are irrelevant, burdensome, and unnecessary.

§417, Section by Section Comments

§417.3

Delete references to Command Destruct System – see comments on §417 Subpart D. Replace references to Countdown with Checklist – see comments on §415.121(a).

§417.9(b)

Given that some vehicles such as USLVs take only 180 days from initiation of project to flight, it is quite impractical to mandate that all vehicles, regardless of size or type, submit the launch schedule, through flight date, six months before flight. Similarly, the Flight Safety System test schedule and Launch Operator Organization, submitted six months before flight, should instead be submitted with the license application.

§417.11(e)

Replace references to Countdown with Checklist – see comments on §415.121(a).

§417.107(a)(3)

As discussed in our response to §417 Subpart D, XCOR strongly opposes the proposed baseline of command destruct as the reference flight safety system, and this section is particularly objectionable, as it requires alternative systems (more appropriate to inland launches) to demonstrate less public risk. Not only do innovative approaches have to bear the burden of overcoming the institutional barriers of federal range practice, but they must also meet a higher safety standard. This is a barrier to, rather than an encouragement of, private commercial development of launch infrastructure.

§417.107(c)

Another example of the inappropriate, one-size-fits-all approach of this NPRM is the requirement for COLA of 200 km separation from habitable orbital objects for suborbital launches. In the three dimensions of suborbital trajectories, not all dimensions are created equal – altitude is a more certain parameter than latitude and longitude. Few if any habitable orbital objects have altitudes below 200 km – a suborbital trajectory with apogee below, for example, 50 km hardly needs a COLA to maintain safe distance.

§417.117, §417.119(b), and §417.121

What is the value served by requiring each review to be scheduled at a time referenced to the planned liftoff? XCOR believes checklists are as valuable as countdowns -- see comments on §415.121(a).

§417.125(i)

Recalling that private high power rocketry efforts will sometimes qualify as USLVs, we are concerned about how this section will be interpreted. While means of tracking are commonly employed in these efforts, they normally do not employ two redundant means of tracking, and have nevertheless compiled an excellent safety record. §417.327 seems to suggest that two redundant tracking systems are required – even though in the case of a USLV using a wind-weighting system, the tracking is not a safety-critical system.

§417 Subpart C – Flight Safety Analysis

The essence of XCOR objections to this section is simple: not all vehicles are Atlas, Delta, or Titan. Even within the field of expendable vehicles, the regulations are drawn so broadly as to encompass the activities of high power rocketry clubs, sounding rockets, rocket-powered UAVs with an exoatmospheric coast phase, aerodynamically stable rockets that employ aerodynamic control rather than thrust vectoring during boost phase and hence have predictable flight paths, etc. Today, the U.S. launch inventory contains only a subset of these vehicles – and these regulations, as proposed, will serve to keep it that way. Consider the various analyses and cases where they would not apply, and bear in mind that the simple act of promising to consider all applicants' requests for waivers does little to stave off the chilling effect on potential innovation.

- Trajectory Analysis: XCOR agrees that, for a nominal trajectory, this is a necessary analysis for all expendable launch vehicles we can envision. As discussed in detail in numerous comments in the February 2000 on-line forum held by AST, wind-weighted trajectory analysis is impractical for small efforts by private organizations because of the inherent requirement for 6DOF simulation, which is beyond the scope of reasonable effort (see the archives for numerous public comments supporting this). Of course, reasonable, rule-of-thumb estimates can and should be made, but the NPRM makes no allowance for this.
- Malfunction Turn Analysis: The benefit of a malfunction turn analysis to a USLV is murky at best. What is the proposed mechanism to force such a turn to happen? What is the significance of the 12 second time after a turn for such a vehicle, lacking a command destruct capability? What of vehicles employing aerodynamic control as well as aerodynamic stability? Vehicles lacking high-authority thrust-vector control don't exhibit the kind of behavior this analysis is intended to cover – but the burden of proof shouldn't be on every USLV operator to show that. It is the FAA who should be justifying the requirement for these analyses, showing why they are required to fulfill the FAA's statutory mission.
- Debris Analysis and Debris Risk Analysis: As noted in our comments on subpart D, every vehicle operation philosophy other than specifically U.S. missile-derived ELVs follow the philosophy of avoiding the generation of debris, rather than following the course of the debris after accidentally or deliberately blowing up the ELV. USLVs covered by this proposed NPRM are designed, built, and launched, with demonstrated safety, by organizations consisting of one to three people. Is the FAA seriously proposing that they conduct debris analyses which, conservatively, require more man-hours than the design, construction, and flight of the vehicle?
- Flight Control Lines & Flight Safety Limits: What does a USLV, with no command destruct package, or for that matter a UAV-like vehicle, do with flight control lines that justify the effort required in developing them? This analysis in inapplicable to that class of vehicle.

- Straight-Up Time Analysis: If the vehicle employs aerodynamic control and lifting surfaces, or takes off horizontally, this kind of failure is improbable at best. Similarly, for vehicles employing no command destruct system, there is no need for information guiding the operator on when to employ command destruct.
- Wind Analysis: XCOR agrees that almost any kind of vehicle requires some kind of wind analysis, although substantial parts of this analysis may be inapplicable for reasons discussed under trajectory analysis.
- No-Longer Terminate Gate: XCOR has no objections to this section.
- Data Loss Flight Times and Time Delay Analysis: Applicable only in a vehicle employing command destruct.
- Distant Overpressure Blast Focus Analysis: Consider comparable vehicles. When experimental aircraft, of novel type and high risk of failure, carrying large fuel loads, conduct flight test, the FAA does not require an analysis to confirm that, if they crash in the desert, no windows are broken! This is a requirement unique to very large vehicles, dating back to the days of the Saturn V. At the very least, for vehicles with liquid fuel (not propellant, but fuel) loads below 20,000 pounds are no greater hazard than aircraft, as long as they are not employing unstable or toxic propellants.
- Conjunction on Launch Analysis: See our comments on §417.107(c)

Many of these concerns were also addressed in the February 2000 online forum on a proposed "light license" approach – the recognition that not all vehicles need comparable levels of scrutiny, as smaller, lower energy vehicles have lower potential for public harm. XCOR recommends that the comments of that online forum should be re-examined and considered in the formulation of new rules after this NPRM is withdrawn and discarded.

§417 Subpart D – Flight Safety System

XCOR believes that the approach taken throughout this section is flawed. As the FAA notes in the discussion of the NPRM at FR, 63925, c. 3, "The other essential component for flight safety is a flight safety system. The primary purpose of a flight safety system is to monitor a launch vehicle's flight status and provide the positive control needed to prevent the launch vehicle from impacting populated or other protected areas in the event of a vehicle failure". XCOR agrees, and there are a number of possible ways in which such a goal can be approached. To name just a few:

- Vehicles can carry a remote destruction package (U.S. practice for missile test launches since a V-2 launch went awry at White Sands);
- Vehicles can terminate their thrust to force ballistic impact at a known point. (Russian and Ukrainian launch vehicles have used thrust termination over a launch history more extensive than the total U.S. experience, and this is the only large database for large ELV operation from an ***inland*** spaceport);
- Vehicles can augment a thrust termination system with deployable drag or lift devices or aerodynamic control surfaces to modulate their impact point for finer control of impact point. (Although not often phrased in these terms, this is a mechanism that enhances public safety for aircraft over flight, and is one of the emerging philosophies in UAV operation).

There is also more than one way to provide positive control

- Multiply redundant radio links with ultra-high reliability and a completely independent power and control subsystem can provide positive control, augmented by a multiply redundant means of tracking the vehicle trajectory. (This has been U.S. practice for missile test launches);
- Autonomous onboard control can detect vehicle anomalies and trigger the flight termination system. XCOR appreciates the FAA's reluctance to rely on such systems without extensive flight history – but hybrid approaches are possible. For example, an onboard FTS initiation system could be backed up by a single string command destruct system, which would only be required when ***both*** the ELV ***and*** the onboard FTS initiation system failed;
- ELVs can carry a crew – in fact, other than the Space Shuttle, all human beings launched into orbit or high energy suborbital trajectories have ridden ELVs. The crew can initiate the flight termination system using positive electrical, optical, or mechanical command links. These means of flight termination can be readily brought to reliability greater than or equal to radio command systems, which far lower levels of design verification than a radio command system requires, and with far lower probability of interference.

Other mechanisms for both flight termination and command initiation will likely be developed if innovation is fostered rather than discouraged by the regulatory process

The FAA's proposal to codify the practices of EWR 127-1 and impose them on launches from private ranges has significant policy implications. In particular, the NPRM explicitly requires alternative flight safety approaches to command destruct to meet a higher safety burden than the command destruct approach. **All vehicles with successful histories of flight over populated land masses avoid command destruct – including Russian and Ukrainian ELVs.** By mandating command destruct, the FAA is effectively prohibiting (or at least strongly discouraging) overland flight for ELVs, regardless of design. The reason why overland vehicles (Russian ELVs, American UAV's, and experimental aircraft, both civilian and military) avoid command destruct is simple – the safest way to fly over land is to keep your vehicle in one piece. That minimizes the spread of debris and the resulting hazard footprint. By keeping the hazard footprint in a small area, public safety can be achieved by directing the impact point away from population concentrations on a fine distance scale – in extreme cases, by steering around individual single-family dwellings.

XCOR believes that establishing this NPRM will have the practical impact of keeping ELV launch at existing ranges, eliminating any practical benefit from establishing the new regulations. Public safety is adequate under current regulations, and the NPRM practices are so restrictive as to provide no benefit in fostering the growth of the commercial industry. The emphasis on command destruct is the strongest reason why XCOR believes the NPRM should be withdrawn and a new rules-drafting process begun. The practices embodied in this NPRM are not "current practice" – there **is** no current practice for private ELVs from non-federal ranges. And the few hints about what private ELV operation ought to be like (Sea Launch, private high-power rocketry, rocket aircraft operation, unmanned aerial vehicles, the Russian ELV experience) have been ignored or dismissed.

As another note, other Federal agencies such as the BATF strongly discourage placing ordnance on guided missiles for sound public policy reasons. Should the FAA continue in their present course, private rocketry would likely find themselves in conflict with federal regulatory authorities whether they place destruct packages on their ELV or not.

In light of our opposition to this entire approach, our comments on individual sections will be brief, intended only to illustrate some of the areas within §417 subpart D which embody the problematic approach.

§417.303

In subsection (b), the NPRM proposes that a flight termination system must render each stage non-propulsive. The benefits from this are obvious, as it ensures that the vehicle will impact in a predictable location. In subsection(e), however, it requires that the flight termination system must disperse the liquid propellant. The advantages of this are not obvious. In the case of toxic propellants, of course, dispersing and burning them in the upper atmosphere reduces hazards on the ground – but in the case of non-toxic propellants, dispersing the propellants, if this requires breaking up substantial parts of the vehicle structure, may actually increase the hazard to the public through generation of debris. Consider, for example a LOX/hydrocarbon fueled vehicle with liquid or hybrid propulsion. Closing the main propellant valves and depressurizing the tanks renders the stage non-propulsive. Venting the LOX might, depending on stage design, be practical through dump valves – but unless the hydrocarbon fuel tanks operate at unusually high pressure, rapid dump of the hydrocarbon fuel might not be practical without breaking open the tanks.

In such a case, breaking open the tanks, compromising the structural integrity of the vehicle, generates debris, and drops hydrocarbon fuel over a wide area. If this were not done, the vehicle would fall with hydrocarbon fuel in the tanks – which might generate substantial fire or a fuel/air explosion on impact, but which would confine public risk to a small zone around the impact point. Depending on the details of the population distribution downrange of the launch point, such an approach might well be safer than breaking up the vehicle at high velocity.

In subsection (g), flight termination is assumed to require command destruct, as discussed and objected to above. Further, radio command is assumed and required, even though, in the case of a vehicle carrying a crew, the crew might legitimately exercise that function without a radio link, with increased safety.

§417.309

For reasons discussed above, XCOR objects to that the assumption that flight safety systems can only be implemented by command destruct, and therefore objects to this entire subsection.

§417.331(d)

For vehicles of new type, how is an organization to develop if the senior flight safety official must have supported the launch of this, or an equivalent, vehicle previously?

§417 Subpart E – Ground Safety

In the explanatory notes at FR, 63942, c. 1, the NPRM states (emphasis added) "The proposed requirements would attempt to ensure that safety issues ***unique to launch*** are addressed, while at the same time ***avoiding duplication*** with the requirements of other civilian regulatory agencies." XCOR believes that there is a potentially large class of vehicles that will restrict themselves to liquid-propellant or hybrid rocket propulsion and use non-toxic, non-hypergolic propellants. XCOR does not believe these vehicles exhibit any safety issues which are unique to launch vehicles and are not already covered by other federal, state, or local regulatory agencies. In fact, the suggested requirements are in many cases more restrictive than those of the other regulatory agencies with greater operational experience in handling these hazards in commercial applications.

Consider, for example, a liquid-propellant stage that employs liquid oxygen and kerosene propellants, and is pressurized by stored gaseous helium. For the sake of discussion, we will assume a pressure-fed system rather than a pump-fed system, so that "command destruct", even if required, can be accomplished through shutoff of redundant propellant valves, rendering the stage non-propulsive, and the propellants can be dispersed through dump valves, expelled rapidly by tank ullage pressure. In such a vehicle, even if adhering to the XCOR-opposed command destruct requirements, the vehicle contains no ordnance package. Alternatively, this might be a large USLV such as a sounding rocket, which is launched under wind-weighting criteria and requires no flight termination system, and hence no ordnance. All actuation takes place with non-pyrotechnic devices.

This vehicle, like many industrial systems, contains hazardous energy in the form of propellant and pressurant. Manual shutoff valves on the propellant lines prevent the liquid rocket engine from starting until the vehicle is armed by opening the manual valves during the pre-launch checklist. The liquid propellants are regulated by long-established fire safety standards, such as those embodied in National Fire Protection Association codes NFPA 30 and NFPA 430. Looking at these in detail, the stand-off distances for these propellants as specified in FAA part 420 can be up to 15 times greater than those called for in NFPA 30 and NFPA 430, even though both kerosene and liquid oxygen are handled in very large quantities in industrial settings every day. OSHA standards, where present, are generally similar to the recommendations of the NFPA. OSHA and NFPA standards also cover the handling and storage of pressurized gases such as the compressed helium in the system.

To summarize, the vehicle employs no ordnance, solid propellants, toxic or radioactive materials, but does include liquid propellants, asphyxiants, cryogens, and high pressure, as listed in §417.405(f). Nevertheless, there are no hazards here not covered by other agencies, and the standards proposed in the NPRM are more restrictive than those required by other agencies. XCOR does not see the justification for more restrictive regulation because a hazard is employed on a launch vehicle instead of a hospital, fuel depot, or semiconductor fabrication plant.

This example vehicle employs construction materials including aluminum, steel, and nickel alloys, and carbon-fiber and glass-fiber composites. These materials are employed in a wide variety of other industries as, for example, aircraft structural components (subject to potential fire hazards from aviation fuels), and storage tanks (including firefighter SCBA tanks which most definitely are exposed to fires!). Local fire authorities, OSHA, and the EPA regulate emission of toxic or dangerous smoke in the event of a fire. Therefore, as listed in §417.405(g), the vehicle does not have the potential for fire including radioactive material or beryllium, but does have the potential for fire including carbon fibers and propellants. Nevertheless, there are no hazards here not regulated by other agencies, and the standards proposed in the NPRM are more restrictive than those required by other agencies. XCOR does not see the justification for more restrictive regulation because a material is employed on a launch vehicle instead of on an airplane or on firefighting equipment.

Looking elsewhere in this section, we see "release of hazardous materials", regulated by the EPA, "unguarded electrical circuits or machinery", regulated by OSHA, "oxygen deficient environments", regulated by OSHA, "potential falls into unguarded pits", regulated by OSHA, "radio transmitters, and lasers", regulated by OSHA. Just looking at the list, these hazards are in no way unique to launch vehicles. Many industries have experience with these hazards, and it is difficult to discern why working around a hole is uniquely more hazardous in a launch vehicle environment than in, for example, construction work. Or why oxygen deficient environments in launch vehicles are uniquely more hazardous than in underground wiring. Nevertheless, these other industries do not labor under the requirement to have these hazards assessed by someone with five years experience in launch vehicle ground operations, as required by §417.405(b), nor do they labor under the requirements of any other aspect of §417.403, nor are their factors of safety dictated by §417.413(c). We recommend this entire section be withdrawn and reworked.

§417 Appendices

Because of our strong objections, listed above, to large parts of §417, we find it impossible to comment constructively on the appendices, as they largely apply to tests we have questioned the validity of requiring.

One specific note, alluded to above, is that the hazard classification and stand-off distances for Liquid Oxygen and RP-1 Kerosene are substantially more stringent than those found in industry practice, OSHA requirements, and NFPA-recommended fire codes.